PROGRESS REPORTS

FROM

EXPERIMENT STATIONS

SEASON 1959-60

NYASALAND

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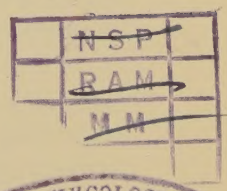

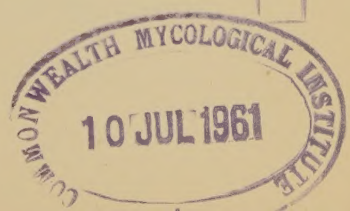

STAFF

Mr. D. F. Collings, C.D.A., works at the Government Experiment Station, Makanga, on secondment to the Corporation's staff from the Department of Agriculture.

NYASALAND

PROGRESS REPORT FOR THE SEASON 1959-60

BY

D. F. COLLINGS

COTTON SEASON

Province	*Type of crop*	*Legal sowing dates*	*Harvest*	*Legal uprooting date*
Southern, Central	Summer	15 Nov.-7 Jan.	Apr.-July	31 July
Northern	Winter	16 Apr.-15 June	Oct.-Jan.	15 Jan.

INTRODUCTION

Weather

Rains were late in starting and below average in quantity. At Makanga 19·44 inches fell during the growing season (December to July) compared with a sixteen-year average of 26·44 inches. January and February rainfall was particularly low and sunshine for each of these months was one and a half hours per day above average. The meteorological data given in Table 1 include readings from both the old (sheltered) site and a new more exposed site which is being brought into use in its place.

An unusually high boll set on the lower sympodia was observed in all cotton on the station, both irrigated and raingrown. This is not the general rule; in fact shedding of early buds and bolls is one of the main problems in irrigated cotton. The unusual weather could account for this deviation from normal; the meteorological aspects of boll shedding require further investigation.

Cotton Production

The crop produced this season was the largest recorded for twenty-five years. Except for the Northern Province, where rats have become a serious pest, production was high in all areas owing to increases in the acreages sown.

The following figures provided by the Agricultural Production and Marketing Board and the Director of Agriculture show the production in the three provinces, with the corresponding figure for the previous season in parentheses.

TABLE 1

SUMMARY OF MAKANGA METEOROLOGICAL DATA 1959-60

	Rainfall (inches) Old site				*Rainy days*	*Humidity %* 6 a.m.		2 p.m.		*Temperature (screen °F)* maximum		minimum		*Sunshine* daily mean hours		*Evaporation *** old site		
	59-60	*Mean*				*59-60*	*Mean*	*59-60*	*Mean*	*59-60*	*Mean*	*59-60*	*Mean*	*59-60*	*Mean*	*59-60*	*Mean*	
		(16)*					(14)		(14)		(16)		(16)		(5)		(6)	
May	0·00	0·76			0	95	90	44	52	91·9	84·9	60·8	60·8	9·7	8·3	6·36	5·18	
June	0·24	0·74			3	96	87	48	54	84·3	80·7	56·7	54·7	7·8	7·1	3·94	3·94	
July	0·69	0·40			5	96	89	48	47	83·7	82·1	57·0	54·4	7·5	7·9	4·77	4·58	
Aug.	0·76	0·37			5	93	87	38	43	87·0	85·6	56·6	56·7	8·9	8·7	5·92	5·66	
Sept.	0·16	0·25			1	88	78	38	40	89·7	91·7	63·1	62·8	8·3	8·5	7·76	7·71	
Oct.	0·63	0·57			3	81	75	32	36	97·0	97·3	68·7	70·0	9·4	9·0	10·89	10·32	
Total	2·48	3·09			17											39·64	37·39	
Mean						92	84	41	45	88·9	87·1	60·5	59·9	8·6	8·3			
	Old site		1-1		*New site*											*Old site*		*New site*
	59-60	*Confidence limits (17)*	*lower*	*upper*	*59-60*		(15)		(15)		(17)		(17)		(5)			*59-60*
Nov.	3·47	1·77	4·72		3·34	7	86	78	42	42	94·3	96·3	70·4	72·4	8·4	8·5	8·75	9·65	10·66
							New†	Old	New†	Old	New†	Old	New†	Old	Old	Old			
Dec.	3·61	4·20	7·79		3·34	10	87	83	38	55	95·7	92·6	74·3	72·3	6·8	7·0	8·95	7·00	9·76
Jan.	5·21	3·68	9·17		5·04	8	95	90	47	65	91·0	91·5	70·1	72·0	8·4	6·9	7·55	6·33	8·44
Feb.	3·69	3·28	8·85		3·63	12	95	91	47	62	92·5	90·6	71·8	72·4	8·5	7·0	6·61	5·52	7·19
March	4·29	2·49	5·15		4·17	9	95	91	63	61	89·0	88·4	69·6	66·3	7·4	8·2	5·75	5·87	6·01
April	0·50	0·37	2·06		0·48	6	95	95	56	54	87·0	88·5	66·0	67·0	7·8	8·5	5·54	5·39	5·68
Total	20·77				20·00	52											43·15	39·76	47·74
Mean						92	88	49	57	91·6	91·3	70·4	70·4	7·9	7·7			
Annual total	23·25															82·79	77·15	

*Number of years over which mean taken.

**Inches from open pan, painted black inside at beginning of October.

†Stevenson screen moved to new site 1st December 1959.

Seed cotton (short tons)	*1st grade*		*2nd grade*	
Trust Lands Northern	156	(400)	9	(14)
Central	555	(223)	104	(46)
Southern	10,114	(8,342)	1,577	(1,004)
Total Trust Lands (both grades)		12,515	(10,029)	
Estates		1,052	(1,022)	
Grand total		13,567	(11,051)	
Total lint (bales of 400 lb)		20,354	(15,650)	

Staff

Mr. J. M. Munro left the station on 26th February 1960 on transfer to Nigeria. The station was then taken over by Mr. D. F. Collings for the remainder of the period covered by this report.

Mr. Collings was seconded to the Corporation with effect from April 1960 and is continuing both the plant breeding work on cotton and the range of agronomic investigations including irrigation trials.

Plant Breeding

The breeding programme consisted of three main lines of work as follows:

Selection within Albar 637 and related Albar 51s.
Selection within crosses between Albar 51 selections and introduced and local varieties.
Work with new introductions.

There was a complete absence of the angular leaf spot symptoms of bacterial blight (*Xanthomonas malvacearum*) on the station and this delayed the culturing of bacteria. When cultures were produced the crop was well advanced in growth and inoculation gave negative results in all varieties.

In variety trials the breaking of cross ties caused uneven distribution of water which in turn gave uneven plant growth and resulted in unusually high standard errors.

Albar 51

The multiplication of Albar 637 has continued, and 1,148 tons of clean seed cotton were produced. Yields were high in areas where rains started early and there was little angular leaf spot. Distribution in the coming season will extend as far south as Nchalo and along the east bank of the Shire as far as Chiromo.

As in the 1958-59 season, the 37 selections from the best four Albar 51 strains, including A637, have not been particularly outstanding, although the general level of yields in both trials (see Table 2) was satisfactory. Eleven selections yielded as well as the control and will be retained for further testing.

TABLE 2

COTTON VARIETY TRIALS

Yields in lb seed cotton per acre at two stations

Variety	*Makanga*	*Ngabu*
CLB (controls)	1024	1428
A637 (controls)	1014	1723
7/104	904	1774
122	947	1700
132	1150	1658
158	1111	1667
230	979	1922
246	1153	1755
262	1001	1686
271	1137	1681
273	1090	1640
282	1207	1691
323	1076	1714
AC31	939	1695
ABC146	954	1139
ABC40	1176	1399
UPA(56)	822	1459
A(56)(22)	913	1301
A367G	920	1649
	S.E. ±102	±85

Six replications at Makanga; three at Ngabu.
Makanga trial sown December 29; Ngabu, January 2.

The Namulonge Albars, A(56)16, A(56)22 and A(56)23, and strain UPA(56)5, introduced for high ginning percentage, have again shown an improvement on CLB and A637. Their yields have not been outstanding and selection for jassid resistance will be continued. Their ginning percentages, together with those of CLB and A637, at three stations are given in Table 3.

TABLE 3

GINNING PERCENTAGES, NAMULONGE ALBARS

Variety	*Chitala*	*Makanga*	*Ngabu*	*Mean*
CLB	33·8	30·8	33·6	32·7
A637	36·6	31·0	33·6	33·8
A(56)16	37·2	32·8	34·6	34·8
A(56)22	36·2	32·0	34·4	34·2
A(56)23	37·0	34·0	36·6	35·8
UPA(56)5	36·2	32·6	34·0	34·2

Albar Crosses

None of the Albar 49 crosses ABC40, ABC146 or AC31 has been outstanding, but they will be retained for further testing. UPA(56) yielded less than the control in one trial, but there are indications that it matures two weeks earlier.

Unselected F_3 populations of the 16 crosses made in 1957 between Albar 51 and four local and introduced varieties were tested against A637 to give guidance as to which crosses were most likely to produce high yielding selections. Similar trials at Makanga and Chitala gave

contradictory results (see Table 4), but this may be attributed partly to the high standard error at Makanga. The trial will be repeated in 1960-61.

Single plant selections made in the F_2 were grown in unreplicated progeny rows. No selection was possible for resistance to bacterial blight. Jassid infestation was high; with discards for susceptibility to this, and for low lint index, the amount of material has been reduced to more manageable proportions and will be tested for blight resistance and yield in the coming season.

TABLE 4

TRIALS OF ALBAR CROSSES

Yields in lb seed cotton per acre at two stations

Variety	*Makanga*	*Chitala*
CLB } (controls)	895	392
A637 } (controls)	1123	621
509	1014	688
513	856	705
514	899	862
516	1012	773
518	917	846
519	1111	752
521	981	688
524	1210	780
BAR HOP 7	459	251
F2	398	403
F18	611	529
F21	692	326
F22	672	12
	S.E. ±96	±16

Plot size 1/145 acre. Spacing 3 ft × 2 ft. 3 plants per hole. Six replications at each station. Makanga trial sown December 29; Chitala, December 10.

Further selections were made for small plants and for high boll set in the bottom two feet. These will be compared under irrigation with A637 and CLB which grow excessively tall under these conditions; irrigation should also minimise the uneven water distribution experienced under raingrown conditions.

Introduced Varieties

The strain BAR HOP 7 (a cross between BAR 7/8.2 and Hopi Acala), and the four families F2, F18, F21 and F22 (from BAR 11/9, homozygous for B_2, B_3 and B_6), were introduced from the Sudan and included with the Albar crosses in the two trials summarized in Table 4. All were very susceptible to jassid attack and gave inconsistent yields; BAR HOP 7 and F22 were particularly poor at Chitala.

Agronomy

Studies of Shedding

Following preliminary observations last year, a formal trial was put down in which two insecticides, Sevin and endrin, and two fruit drop hormones, Planofix and 2,4,5-TP, were to be sprayed on three varieties, weekly from 1st January to 15th February, in a 3 × 3 × 3 factorial layout. The 2,4,5-TP caused growth distortion of the plants, and this treatment was stopped after two applications.

The trial was sown on 15th November with supplementary irrigation, so that flowering would take place in January and February. The increased yield from the hormone treatment last year was entirely due to a reduction in the shedding of fruit from flowers opening during these two months. Sheds were collected regularly during the period of the spraying, and harvesting was completed in ten pickings.

Table 5

Cotton shedding experiment, Makanga

Yields and counts of shed buds and bolls

Treatment	*Seed cotton yield lb per acre*		*Number of sheds collected per acre*		*Gain in yield to Mar. 31 from reduced shedding to Jan. 29*	
	Total	To Mar. 31	To Jan. 29	To Feb. 16	Expected	Actual
Varieties (complete replications)						
CLB	2269	752	10,863	98,851	—	—
A637	2549	721	9,366	89,746	+15	− 31
UPA	2034	1044	5,722	88,576	+51	+292
Insecticides						
Control	2019	455	11,222	99,734	—	—
Endrin	2336	630	7,772	82,505	+34	+175
Sevin	2496	1436	6,957	94,930	+42	+981
Hormones						
Control	2291	965	10,820	103,719	—	—
Planofix	2490	1040	8,882	99,630	+20	+ 75
2, 4, 5-TP	2070	515	6,250	73,821	+45	−450
S.E. (not applicable to variety yields)	±167	±76	±814			

The results given in Table 5 appear at first sight to contradict last year's observations, when Planofix gave an increase in yield and insecticide appeared to have no effect. Conditions this year were, however, very different and probably atypical; the shedding in January and February was much less severe than usual, apparently connected with the dry sunny weather, and there was little or no difference

between the hormone treatment and the control. The increased yield from the insecticide treatments requires confirmation over a number of seasons, as any infestation is likely to be affected by climatic conditions. Much of the increase in fact came from the variety UPA, and may have been the result of jassid control in a relatively susceptible variety. UPA also yielded a much bigger crop in the first three pickings than the other two varieties (A637 and CLB).

Significant reductions in the number of sheds collected were recorded at various dates in the Sevin and endrin treatments, and in the plots receiving 2,4,5-TP. This treatment was also found to delay the abscission of the corolla very markedly. A relationship between reduction in shedding and earliness of harvest, as expressed in the yield of the first 3 picks, was sought by analysis of covariance and by calculation of the expected gain in yield on the basis of one pound of seed cotton for every 100 bolls retained. The differences in yield of the first 3 picks were not satisfactorily explained by recorded differences in shedding; the increased yield with Sevin was far greater than the reduction of shedding would lead one to expect while 2,4, 5-TP reduced shedding but also gave a lower yield in the first 3 picks owing to the damage it caused to the plants.

Interplanting of Cotton and Maize

It was planned to repeat the experiment reported last year when interplanting gave significantly higher yields of maize and cotton from the same area of land than pure stands. The late advent of the rains telescoped the early and late sowing dates of the cotton into one and only a simple comparison of pure stand and interplanting was possible. The results in Table 6 show no difference in yield between the methods, the effect possibly of a drier year which also greatly reduced maize yields.

TABLE 6

INTERPLANTING OF COTTON AND MAIZE, MAKANGA

System	*Yields in lb from 2 acres*		
	Seed cotton		*Shelled maize*
1 acre pure stand of each	1362	+	887
2 acres interplanted	1341	+	928
S.E.	±84		+132

Ridging and Mulching Trial

Comparisons of ridging (with and without cross ties) with flat cultivation, and of mulching (at two levels) with no mulching, were continued; the test crop this season was maize.

As with the groundnut crop, reported last season, the results suggested that very substantially higher yields may follow the employment of either ridging or mulching, that crosstied ridges can give a clear advantage over open furrows and that heavy mulching is superior to light. The response this season to mulching was particularly impressive; the yields are given in Table 7.

TABLE 7

RIDGING AND MULCHING TRIAL

Yields of shelled maize in lb per acre

Flat	1337
Ridged	1553
Ridged and crosstied ...	1767
No mulch	768
Light mulch	1857
Heavy mulch	2034
S.E.	±171

Rotations and Continuous Cropping

Trials of various rotations and of continuous cropping were continued from previous seasons with cotton, maize, groundnuts and legumes. None of these trials has yet reached a stage at which firm conclusions can be drawn. No very wide difference in cotton yields occurred this season; even the "exhaustion plot" gave 614 lb of seed cotton per acre.

Irrigation Trials and Investigations

Field experiments on irrigation of a wide range of crops and studies of soil moisture changes and of evaporation were continued. One trial was of supplementary irrigation of cotton. All previous attempts to increase cotton yields by irrigation have failed though yields of over 2,000 lb per acre have been obtained apparently as an after effect of dry season irrigation. There is some evidence of correlation between yield and the rainfall during January and February. The experiment described below was an attempt at increasing yield by giving supplementary irrigation within this period and also in March.

These supplementary waterings were given to cotton sown in early December and grown up to the 3rd January on three different irrigation schedules. The design was a 3 × 5 factorial with split plots, the supplementary irrigation from January onwards being allocated to the subplots. The treatments given, and the yields obtained, are set out in Table 8. Dry sowing was included for comparison with sowing after an irrigation because it had previously given better results, and two different rates of presowing irrigation were compared.

TABLE 8

SUPPLEMENTARY IRRIGATION OF COTTON

Yields of seed cotton in lb per acre

Treatment		*Yield*
Dry sowing followed by irrigation at a factor of 1·6 until January 3rd.		2546
Six inches of irrigation water before sowing followed by irrigation at 1·0 until January 3rd.		2174
Twelve inches of irrigation water before sowing followed by irrigation at 0·4 until January 3rd.		2068
S.E. (two degrees of freedom)		±135
Irrigation at a factor of 1·6 for:	January	2139
	February	2462
	January and February	2250
	February and March	2250
	March	2174
	S.E.	±133

The amount of water given over the period up to 3rd January was adjusted so that the total, including that given before sowing, should be the same for each treatment. It was estimated from previous records that quantities representing 1·6, 1·0 and 0·4 times the open pan evaporation would provide the correct amount over this period for the dry sowing, the six inches and the twelve inches of presowing irrigation respectively. The evaporation readings used were from the open pan evaporimeter at the old meteorological site. Calculations using Penman's formula agreed well with these.

These irrigations ceased on 3rd January and subsequent irrigation was at the factor of 1·6 only, applied for the periods listed in Table 8.

There were no statistically significant differences in yield between the treatments though dry sown plots and plots irrigated in February averaged somewhat higher yields.

Other Experiments

Variations of spacing and applications of nitrogen were introduced as additional factors in studying the water requirements of maize. Neither irrigation nor change of spacing produced significant yield differences, but there was a statistically significant response to application of nitrogen and an interaction between nitrogen and water; at a low rate of watering there was no response to nitrogen.

Other experiments were conducted on wheat, potatoes, groundnuts, soya beans, linseed, sesame, rice and several vegetables. Work was also carried out on perennial crops including lucerne, cocoa and sugarcane.

Appendix

Origin and special characteristics of the main cotton strains mentioned

CLB	Crown Land Bulk, the commercial variety of Nyasaland, mainly of U4 origin.
CL20	A selection from CLB, with longer and finer lint.
A637	An Albar 51 selection ex Uganda, which is being multiplied to replace CLB in Nyasaland.
A629 A640 A474	Albar 51 selections ex Uganda.
ABC30, etc.	Selections made in 1955 from the F_4 of a cross (Albar 49 × BP52) × CL20.
AC31	A selection made in 1955 from the F_4 of a cross Albar 49 × CL20.
A(56)16, etc.	Albar 51 selections made at Namulonge in 1956, showing high ginning percentage.
UPA(56)5	A selection made at Namulonge in 1956 from hybrid material (MU8 × $BP52^2$) × Albar 51.
BAR 11/9	BAR 11/7 with B_6 added.
BAR HOP 7	A hybrid, BAR 7/8.2 × Hopi Acala. Imported from the Sudan as high yielding with good spinning quality.

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PROGRESS REPORTS FROM EXPERIMENT STATIONS

The reports for the seasons up to and including 1950-51 were published in seasonal volumes; the following are still in print and available at 3/- per volume post free.

1923-25 (one volume), 1926-27, 1931-32, 1934-35, 1935-36, 1942-43 and 1945-46 to 1950-51.

From 1951-52 the reports from each territory were published individually each season. A few of the 1951-52 reports are out of print, but all others are available post free at 2/6 per report or £1 for the seasonal set.

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